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WWU Honors College Senior Projects. 577.
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**Growing through Climate Change:
Food and Farm Resiliency Post-Disasters**

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ISP Spring 2022
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INTRODUCTION

Agriculture is a substantial part of Whatcom County's (WA) economy. The business supports many families, both those who participate in agribusiness and those who purchase from said businesses, which often entails exporting the product outside of the county. However, both of the factors that create a stable relationship between the consumer and the agriculture sector are threatened under the rise of more reliably consistent natural disasters due to climate change. This paper explores how Whatcom County farmers are supported in handling natural disasters that impact their crops and general agriculture productivity.

For the purpose of this research, the term 'natural disaster' and 'disaster' are used interchangeably in reference to the fact that the rate the climate is changing is not natural, and the resulting disasters are therefore not natural either. However, the vernacular that is used in this context does not fully acknowledge just how unnatural this process has been made through the participation of human-driven practices.

LITERATURE REVIEW

Contemporary North American settler agricultural systems and practices have semi-shallow roots. White settlers acquiring land by means of stealing it upon initial settlement does not set up a developing society for success. New and unfamiliar land results in the popularity of trial-and-error methods, word of mouth, as well as various other means of approaching agriculture and food cultivation systems. Eventually, as society developed, as did the food systems that supported it. The reliance on maize farming, alongside the development of social formations, in the years C.E. 800 to 1100 showed a large change in traditional farming in the eastern region of what is now called the United States (Smith, 1989, 246). From this point forward, developments in early agriculture styles continue to shift alongside the social dynamics (Smith, 1989, 246). Advancements in technology and practices show the ways in which society interacts with agriculture. In other words, agricultural tools and practices are constantly developing alongside the world that houses it. In short, the tools that are utilized in agricultural practices are a reflection of the region and time period that they exist within.

However, examining the state of agriculture today and the processes it relies on exposes the ever-evolving approach to agriculture as the health of the environment around it evolves. The Civil War and the abolishment of slavery was a turning point within agricultural practices, and this pushed the nation closer to modernized and mechanized practices of agriculture, an effort that was solidified post-WWII (Hurt, 2002, 163; Fitzgerald, 2003). Fitzgerald writes that "[t]he success of mechanized farming in one place with one kind of crop could be easily translated into the belief of the general superiority of mechanization" (Fitzgerald, 2003, 186-187).

Overall, agriculture is a large contributor to national economic stability: there are around 2 million farms across the county, and the annual gross income from the sector is between \$300-350 billion in a fiscal year (Walthell et al., 2012). It is a section of the economy that is always fluctuating. Jumping forward, in contrast with the pre-mechanical era of

agriculture, the 1990s agriculture era has become more mechanized, and the overall number of farms has dropped as some farms continue to expand (Walthell et al., 2012). The trend towards a fewer number of farms, and the size of the farms increasing, shows how the development of tools has changed the style of this industry. This has also resulted in the popularization of specialized farms or monoculture farms. Figure 1.1 displays how much agribusiness has grown in exports from 1935 to 2010 in terms of billions of dollars.

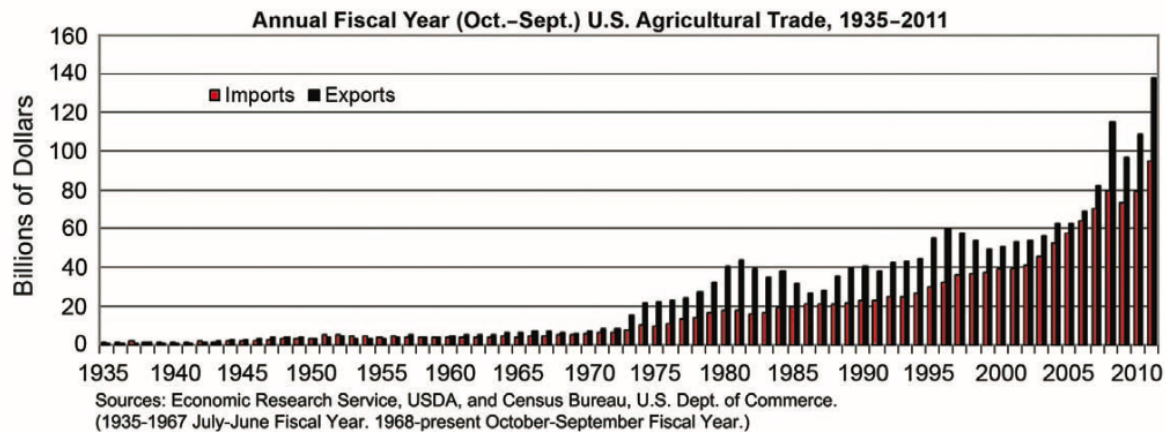


Figure 1.1: Annual fiscal year (Oct–Sept) U.S. agricultural trade, imports and exports, 1935-2011. (USDA)

Despite the changes that agriculture in the United States have undergone, especially since the 1930s (crop specialization, the growing presence of industrialized farms, the change in the amount of revenue generated, etc.), perhaps the one that weighs heaviest is the threat that climate change poses to its regularity and degree of reliability. Planning for crops based on the semi-predictable weather patterns of a region utilized for agriculture is an essential part of the growing and cultivating process. Though unpredictability is always a factor in the realm of weather patterns, the exacerbation of said unpredictability due to climate change makes that burden heavier. The ways that climate will interact with agriculture greatly depend on how various crops respond to increased CO₂ levels, longer and hotter seasons, increased precipitation rates, and all of the other subsequent realities of a changing climate (USDA). The ways that climate change is set to impact agricultural production rates and crop yields are multidimensional. There is an element of economics to consider if crop yields are heavily damaged, or if they turn to be more fruitful. Either of these possibilities could be a reality, though the amount of fluctuation and type of carbon that dominates the atmosphere has a large impact on either potential outcome (Hatfield et al., 2011, 353). Many crops have a maximum change in temperature that they can tolerate before the outcomes become less predictable and more disastrous (Lotze-Campen & Schellnhuber, 2009, 146).

Alongside this notion is the scenario in which “cultivated land” is acquired or utilized for the purpose of agriculture. It is predicted that North America will see a total increase of

40%, over 360 million hectares, because of the longer growing period that could likely be brought on by a shift in climate (Fischer, Shah, Tubiello, & Velhuzien, 2005). Another dimension of agriculture that needs to be considered is livestock. Livestock presents an element that requires management and heavy observation, as food accessibility and agribusiness depends on the health of the involved livestock (Walthell et al., 2013, 94). The manners in which livestock interacts with the environment depends on its overall health, and contribute greatly to the economic sector of local and national agribusiness.

To narrow down this scope, the ways in which climate change has already impacted agricultural practices are numerous. Drastically changing weather patterns and water availability, whether it be too much water or not enough, are just two examples of how the landscape and elements interact with agriculture in vital ways. To specify, Washington state has already seen an increase in coastal marine temperatures (Roop et al., 2020, 8). There is a range of temperature changes that a crop can withstand before it is damaged. An example of such drastic impacts can be seen from the 2021 heat dome in Whatcom's larger region. These dramatically increased temperatures lowered the county's raspberry harvest by 30% (Bratt, 2021).

The dialogue surrounding the impacts of climate change on agriculture in the U.S. centers around the unpredictability of it all. The ways that perennials are impacted will vary region to region, and the complexity of the climate becoming less reliable and generally more extreme will greatly impact the crops that are able to thrive (Lobell & Field, 2019).

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Farmers use a variety of strategies on an individual level to address the impacts of climate change. These strategies include varying planting time, approaching water management in a more conservative style in effort to reserve resources, changing the crop varieties that are grown, adjusting the scale of what is being harvested, and so on. A lot of these strategies aim to defend or restore the land or water available to the farm, while the other avenue of approach is one aimed to address the economic crisis that would follow after a disaster (Berardi, Green, & Hammond, 2011). The ways strategies are employed depend greatly on the type of farm that is employing them. This translates to the necessity of knowing how farms will be impacted. This also creates a call for a universal understanding that climate will have region-specific impacts which will greatly vary, as well as "perceived risks associated with labor, profitability, and excessive regulations, there was an emergent theme regarding the perceived risk of an 'ignorant society'" (Lane et al., 2017, 201). There have been shifts in equipment and methods used in an attempt to be more efficient in the use and distribution of resources that are imperative to the operations in agriculture, such as water (changing irrigation styles or tools is one example of such shifts). These shifts can be in collaboration with organizations that specialize in these efforts. Local to Whatcom County is the Whatcom County Conservation District office, which works closely with farmers in the county to ensure that efforts are being made to best utilize the resources that are available

Changing the approach to resource management is just an example of one strategy being implemented.

Tying into this conversation is the discussion of scale – i.e. the size of the farm – and the interconnectedness between farms and the populations that they are feeding. The scale of the farm directly impacts how much food is able to be grown, harvested, and distributed (Hammond, 2011). The relevance of scale is pertinent to the existence of aid in a post-disaster setting. How the aid is received, what aid is needed, and so on, are all questions that would be applied differently should the answers vary between micro, meso, and macro level farms. The distribution of food goes hand in hand with the action of exportation of the food. Exporting produce is only one factor that makes the industry profitable. However, what must be considered are the problems that arise when this aspect of business is disrupted. Food security is not a guarantee within Washington State due to the high percentage of food that is globally distributed (Paci-Green, Berardi, 2015, 694). Therefore, in an effort to address the inevitable disruptions in the food systems that would occur post-disaster, localizing produce and placing the system on a smaller scale is an essential strategy to adopt in the face of climate-driven disasters. With this in mind, engaging communities within their own food processes can be interpreted as a strategy to be employed on farms of all sizes (Pingali, Alinovi, & Sutton, 2005). Alongside this strategy would be the development of better irrigation and water distribution strategies, tools to manage excessive heat, as well as updated infrastructure in the county (road repair, for example) to better support the agriculture industry.

Individual strategies being relied on within the realm of agriculture and disasters vary greatly from farm to farm. For some contextual examples, one strategy to adopt would be changing the time that crops are planted to be better suited to the rain levels, or maybe changing the crop itself that is being planted to better withstand the changing weather of the region.

In summation, preemptively strategizing to prepare for the event of disasters is relevant to prepare for climate change impacting agriculture. Localizing food systems is one approach that could be adopted to efficiently strategize for natural disasters.

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Overall, there seems to be a lack of overarching updated agricultural infrastructure in place that would work as a safety net against disasters in the United States. This is seen in the efforts made by agricultural lobbyists who work to advocate for the unmet needs of the rural and farming communities (Lowe, 2014). There have been some significant efforts on the national level to try to improve infrastructure in an attempt to keep the United States as a major player in the agriculture realm. One of the big suggestions for infrastructure improvement is the continued maintenance of county roads, as these are often unattended to and make it more difficult to transport produce to be sold.

The organization Rebuild Rural Coalition is a national program that exemplifies the efforts in place to try to better rural America and keep communities as updated as the urban and more popularized areas (Committee on Agriculture, 2017). They have made the call for

infrastructure updates in relation to water availability and distribution, with the potential solution being a change in irrigation style (Zhang et al., 2015). However, this approach depends heavily on the crop being grown and the region housing it (Zhang et al., 2015). Zhang claims that “It has to be stressed that removing the 40% surface irrigation system and complete adoption of greater-efficiency irrigation systems is probably unrealistic because surface irrigation predominates in some regions for certain crops and for salinity control”. The approach to changing the irrigation system in order to address the issue of water availability is a long process, and should therefore be prioritized as an approach to coping with climate change.

This concept is reinforced by Martinich and Crimmins, who claim that adaptation efforts need to be specifically modeled to the region they are attempting to support, and that efforts will be ineffective if not correctly applied (Martinich & Crimmins, 2019). This research aims to talk with the Whatcom County farmer to better understand how they are approaching such disasters. Simply put, the question posed inquires about the methods being used on an individual level, and if aid from the county is successfully being distributed amongst agricultural workers.

AGRICULTURE AND CLIMATE CHANGE IN WHATCOM COUNTY

The agriculture sector in Whatcom County (marked ‘37’ in Figure 1.2) is overall very successful. It is within the top 3% of farm production within the United States, and has over 100,00 acres of farmland (Choose Whatcom). It pulls in an average of \$360 million in annual agricultural revenue, and has more than 1,700 farms with different specialties and approaches to farming (Choose Whatcom). According to the Whatcom Family Farmers website, Whatcom “raises the largest per capita crop of red raspberries in the world, with approximately 100 growers harvesting over 8,500 acres” (WFF). The county dairy industry has a market value over \$193 million, and in terms of beef production, the county is ranked 4th in the state with over 6,000 head of beef relying on the land (WFF). The county markets itself as a place to expand one's agriculture-oriented business by boasting the success of the already established farms in the area. Figure 1.3 shows some of the ways in which Washington State has been and will continue to be impacted by climate change, including lower snowpack levels, shrinkage in Washington glaciers, earlier and longer peak streamflow dates, amongst others.

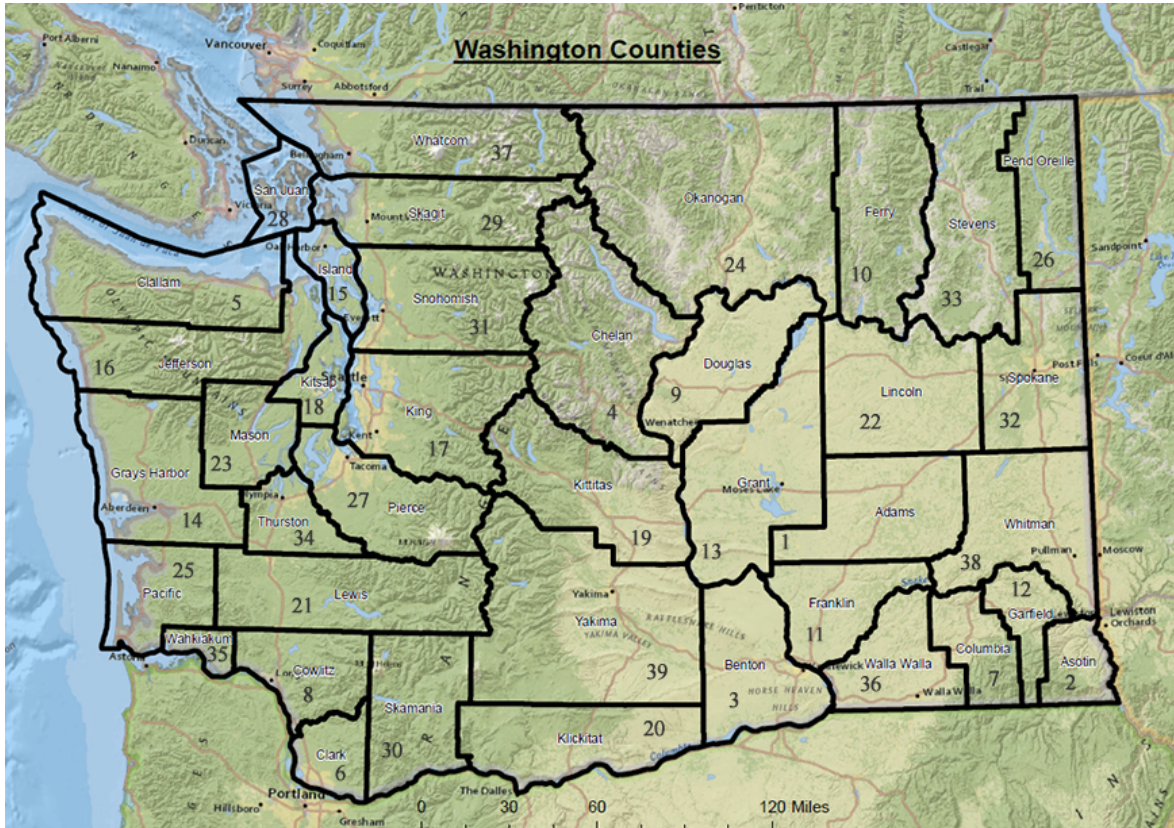


Figure 1.2: County Map of Washington State
<https://www.crab.wa.gov/counties/county-map>

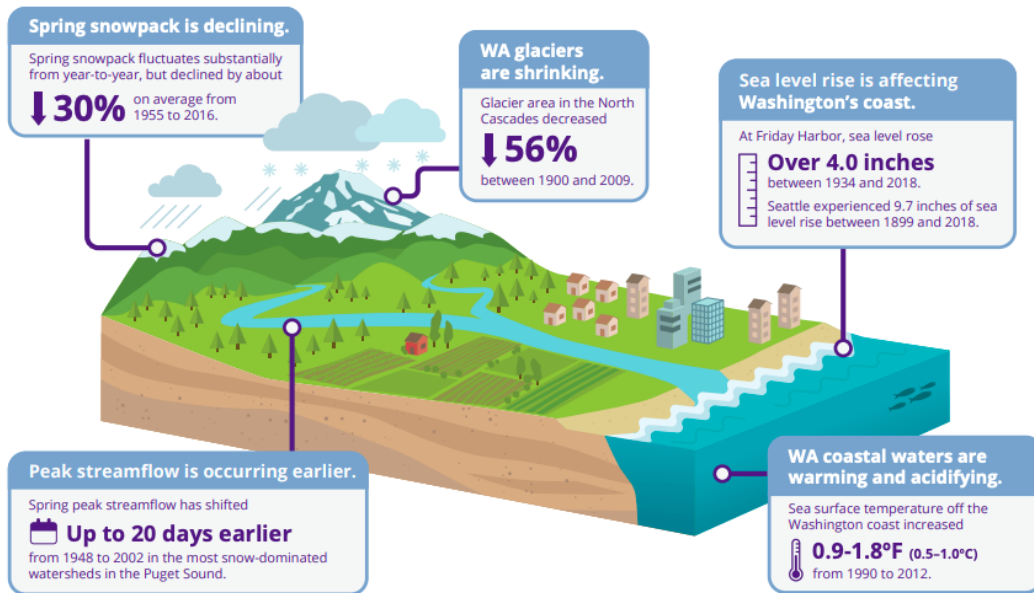


Figure 1.3: Impacts of Climate Change in Washington State
https://cig.uw.edu/wp-content/uploads/sites/2/2020/02/CIG_SnowlinesShorelinesReport_2020.pdf

Thus far, the relevant disasters that have impacted farmers in this region are most notably the floods that occurred in Whatcom and Skagit county in November of 2021, the atmospheric river in the Pacific Northwest region in February of 2022, and the what dome that dominated the region during the summer of 2021. In regards to the flooding, the United States Geological Survey recounts that “a 100-year flood happens about once every 4.5 years on at least one western Washington river draining to Puget Sound”, meaning that a flood of the magnitude of the 2021 is not a completely unheard of occurrence for the Western Washington area, but it is unheard of for most farmers. The rain and wind in the region in November 2021 was up to 50 mph and 4.5 inches of rainwater that cannot be absorbed by the land because it is too saturated (Lukpat & Taylor, 2022). This tremendous amount of rain greatly impacted the farmers in the county. One of the pricier impacts that occurred from this rain was the damage that expensive tools and equipment experienced. Issues such as these presented themselves throughout the county. Reflecting on this information puts into perspective the magnitude of this disaster, and also brings to mind the fact that occurrences such as these should be expected and an increasing rate should the ecosystem continue to be impacted in the ways described in Figure 1.3.

It was an incredible amount of precipitation that impacted counties all around the PNW region, Whatcom included. Again, the soil saturation was overburdened and unable to fully absorb the amount of liquid that was trying to permeate it. Flood and avalanche warnings were issued along the Cascade Mountain range, and landslides threatened the highway commuter as trees and debris slid onto I-5 and other major roads, an issue that presented itself in Whatcom County, which houses a section of the major highway. The highly forested region was under threat as winds and rain made it dangerous to be outside. Again, this was another situation, closely following the events of the floods, that presented challenges to an industry that relies on the weather and its predictability to sustain their business.

Whatcom County has marketed itself as a great place to farm. With this in mind, it is interesting to note that the conversation concerning agriculture disaster preparedness is not heavily ingrained within that marketing plan. Taking it one step further, it is interesting to note the direct absence of such conversations within local policy initiatives.

METHODS

The overall population that was being researched was the farming community of Whatcom County. The sampling method that was utilized was one that aligns the most with judgemental sampling. The process of such sampling practices was one that included researching what farms were in the county and acquiring their emails if they had been made available to the public. The applied methods used in this study focus on lived experiences that vary based on the farm, the business model, the agriculture style, the crop, and so on. To better understand farmers' experiences and preparation with natural disasters, I hosted a focus group. For the purpose of this research, ‘focus group’ and ‘listening sessions’ are terms that are more

or less used interchangeably. Hosting a listening session where farmers are able to discuss the ways in which they have been impacted by disasters is the most effective tool in attempting to build a comprehensive understanding of the relationship between incidents and agriculture. The listening session resembled a guided conversation. By providing the framework for the discussion and then taking a step back, participants were able to build on shared experiences with one another and talk about the ways in which they were impacted.

The operations style of farms that sell to Dairygold, and subsequent management styles that they might utilize in the face of disaster, was a group and a topic that was of interest. However, the accessibility and communication practices of these businesses make it difficult for the average undergraduate student to get a hold of them via email. Therefore, 20 farms who made their information accessible were emailed in an attempt to hear at least one perspective on the issue that was being investigated.

I was able to have a conversation with two of the farms that I reached out to, which resulted in meeting with three farmers. These farmers all operate small-scale, organic farms that work closely with the community. The focus group was held on Sunday May 15th at 6 pm via Zoom for 60 minutes. The semi-structured focus group guide is included in Appendix A. The analysis process that followed the listening session was a process of listening for the most impactful statements that the farmers offered me, and then categorizing them into three main sections that highlighted the areas that they overlapped. These categories are organized in the results section of this paper.

This study was deemed exempt by WWU's Institutional Review Board (see Appendix B). Pseudonyms and not explicitly stating the names of their farms were used to protect participants' identity.

RESULTS

The results of this discussion exposed many of the frustrations the small-scale, organic farmers face in Whatcom County. This differs from the original intention of the research which had been to speak with a larger variety of farmers.

The natural disasters that were offered to the participants to reflect on were mainly the Whatcom flooding in 2021 and the heat dome from summer 2021. This framing was meant to allow the farmers some context to put the conversation into in an effort to ground them in the realm of disasters. With this in mind, the farmers reflected on the ways in which they were able to manage those specific disasters and the conversation was able to flow from that point onward.

Three main themes emerged from these conversations: community interactions, neighboring large-scale farms, and resiliency.

COMMUNITY INTERACTIONS: Farmer Stephanie, noted that the community is a resource that uplifts small-scale farmers through their consumption and general participation. However, Stephanie also noted that in an environment facing an ever increasing risk of

disasters within the ecosystem, there is the risk that the community might be seen and used as a safety net for the inexperienced and ill-prepared farmer to fall back on, thus defining this as a one-sided relationship. They phrased their concerns surrounding the vulnerability of the farmer and the reliance on the farmer as such: “And I can see people making poor decisions and wanting the community to bail them out. And it's like, it depends on how far on either way you're leaning, that's, well, we already kind of have that system with the industrial food, like it's all subsidized with taxpayer money. It wouldn't work otherwise”.

One of the solutions proposed by Farmer Stephanie was modeling a Whatcom County community Food Hub after the one that has been in conversation for many years in Snohomish County. This concept is expanded on in the Discussion section.

THE COST OF BEING SMALL: When talking about the relationship between the small scale farmer and big agriculture businesses in Whatcom, Farmer Timothy, had commentary on the way that their farm was managed by the county in relation to larger farms by recounting “We don't count as farmers in [the government's] eyes because we are not doing a million dollars in potatoes every year”. The dismissal of the small farmer in favor of the more industrialized farm was a strong feeling that was shared amongst the members of the focus group. This relates to disaster preparedness concerning the distribution of resources, and what is available to who.

The scale of the farms that I talked with came up a couple of times. In one instance, Timothy was reflecting on how even if it meant it was easier to receive aid or support in the event of disasters if the farm he operated was larger, he still would choose the set up he currently has. This is because he values the connection he is able to foster “[to] the land”, which in his view makes it easier to deal with unforeseen circumstances such as natural disasters.

One of the strategies that was mentioned by the farmers was the method of using mud to cover the green houses in an effort to keep them from getting too hot for the crops to handle. This tactic was mentioned by Zoe, and put into perspective the amount of work that can be dedicated to small-scale strategies if there is the time and space for such activities. If Zoe operated a larger operation, it is interesting to reflect on mud being put on the roof of the greenhouse would have been achievable for the larger farms. The smallness of her operation seemed to make the adaptive and creative strategy one that would not take a lot of effort to employ, and it is interesting to reflect on the possibility of such a strategy being used in another setting.

RESILIENCY: Participants had a great deal to say about resiliency. Farmer Zoe said, “[...] If we have a failure in one aspect, we have everything else that you know, in an ideal world will keep working. [...] Quite frankly, if we have a year where everything fails, we've got bigger problems going on in the world, then [my farm] doesn't have anything. Because if everything fails, it's like a catastrophic regional type event rather than a personal singular farm type

event”. Farmer Timothy stated that the infrastructures in place to support farmers after a disaster happens, like grants made available by the USDA, are mostly for the large farms in the county, and that “by its very nature, [I] think has made the smaller farmer more resilient”. This ties into another aspect relating to the resiliency, but one that had more to do with land management practices in the county. Zoe tied this concept in with the flooding that occurred in the county and beyond in November of 2021 by stating that “[...] the reason that [the flooding] impacted the areas so much is because we are now building and storing equipment and keeping supplies on traditionally flooded ground”. This was a substantial storm, and the ways that farming tools are stored does not adhere to the storm happenings and the damages that resulted. Again, Zoe recounts that “[...] we're acting like floods are a rare occurrence, when we should be acting like a flood is something that happens every single year, and then storing our equipment and storing our seeds and storing our fertilizers and storing our animals accordingly”.

The result of this conversation showed that, for these farms specifically, there was not a great deal of disaster preparedness conversations happening. However, all of the participants offered incredibly valuable insights on the relevant topics. The space created allowed for a successful conversation that had a structured flow and plenty of content. The interconnectedness of the three main topics offered a lot of overlap in statements.

DISCUSSION

The limitations that presented themselves in this research are most notably the number of participants, and the lack of variety in farming styles of participants. The farms that had made their emails available to the public were few in numbers, and the ones who had were mostly the small-scale organic farmers in the county. Therefore, this ended up being the demographic that made up this conversation. However, there were still a number of insights gleaned that made the conversation productive in this manner. An example of such insights are the feelings shared about the Snohomish County food pavilion that centered local farmers and fostered a connection to the community, and the desire for a structure similar to that to be built in Whatcom County.

Relating the food pavilion to Farmer Zoe’s previous statement regarding a situation where everything fails, the need for a centralized point for farmers and community members to interact and understand the positionality of one another post-disaster is incredibly valuable. More or less, the message that Zoe’s statement relays is that should agriculture face a complete shutdown on all realms of participation, the main concern for this farm would not be profit or produce, but that state of the environment that they are occupying. If this is so, then it can be assumed that the entire community is facing the hardship of environmental disasters. Fostering the relationship between farmers and the community creates the opportunity for mutual efforts in supporting one another.

After the listening session, it became clear that the agriculture sector in Whatcom County is one that is greatly affected by the inclement weather the county has experienced thus

far. It was apparent that preparedness is not on the forefront of the small-scale farmers mind. However, there were a small myriad of suggestions from small-scale farmer, as listed in this section, that would make the agriculture scene in Whatcom County more stable in general, but especially in the instance of disasters. The major suggestion from one of the farmers was to create a food hub similar to the Food and Farm Center in Snohomish County. This is a model that will allow farmers access to “equipment and infrastructure for the processing, aggregation, distribution, value-added production, direct and wholesale sales of locally produced agricultural products”, as well as a commercial kitchen that would make value-added production more accessible (Snohomish County). Creating a central point of community where people can directly interact with the farmers and their produce, as well as offering farmers a space to successfully develop their agriculture practices through means of washing and selling their produce, greatly relates to the onslaught of natural disasters.

Should an event occur that would disrupt business as usual at the food pavilion, the community would have a more direct way of interacting with those populations and would ultimately be more inclined to support them. When a disaster occurs, it is typically an event that impacts the community as a whole, with individuals facing their own version of the hardship that was brought on. With this in mind, the relationship between farmers and the community post-disaster should be one that uplifts one another. In order for this to happen, laying the foundation of a positive relationship between the farm, no matter the size, and the community is a crucial step within the principality of disasters. This would be one step that can be taken to prepare for a world that houses an increasing amount of disasters.

Normalizing disaster conversations would be another strategy that could be implemented to better prepare farmers for whatever they might face. Paralleling this action is the tactic of sustaining the livestock by planting crops with the intention of them acting as feed should feed costs continue to rise. These prices can prevent farmers from purchasing the feed required to sustain their livestock, and Farmer Zoe mentioned growing your own feed as a method to combat these pressures.

It seems that most of the disaster preparedness has resulted from the disasters that have already occurred. These disasters are in part the result of a rapidly changing climate, which creates a global community that is continuously developing methods in an effort to cope with such changes.

Revisiting the concept of support for agriculture systems is the fact that preparing for disaster greatly depends on the size and scale of your farms, as this impacts what resources are available to you. For instance, the United States Department of Agriculture relays the policy and procedures that are available to those who want it, one of which is called the Area Risk Protection Insurance and “provides protection against widespread loss of revenue or widespread loss of yield in a county” (USDA). However, there are certain barriers that make it more difficult to ensure that the crop that would be lost in the event of a disaster would be compensated for or replaced. Overall, there was a general feeling of exclusion from the farmers when it came to county-wide implemented infrastructures that would support their livelihoods

and businesses should they experience hardships as a result of disasters. On top of this, it became apparent that an increased number of support-oriented infrastructures from the county itself would benefit the agriculture scene, especially amongst the small-scale farmers. This would look like the previously mentioned small-scale farm specific grant to aid in disaster recovery.

Resources are available to aid farmers should their crops or livestock fail due to natural disaster. These resources are available through the USDA and various grants provided by the local government such as the previously mentioned Area Risk Protection Insurance, as well as other programs like the Livestock Forage Disaster Program, Noninsured Disaster Assistance Programs, and a number of others. However, there are a number of barriers that exist and prevent some farms from benefiting from aid efforts on the larger scale. Some of the barriers, disguised as eligibility requirements, are listed on the USDA website as follows:

“Farmers...

- Are established family farm operators and have sufficient farming or ranching experience;
- Are citizens or permanent residents of the United States;
- Have suffered at least a 30 percent loss in crop production or a physical loss to livestock, livestock products, real estate, or chattel property;
- Have an acceptable credit history;
- Are unable to receive credit from commercial sources;
- Can provide collateral to secure the loan; and
- Have repayment ability.” (USDA, Farm Service Agency, Emergency Loan Program)

Resources such as these USDA programs being made available to any farmer that applies, regardless of citizenship, percentage of crop loss, credit history, and so on, are another example of strategies that should be actively marketed and utilized to support the agriculture industry post-disasters.

My research suggests that farmers could be better supported given the increased risks of natural disasters under climate change if organizations, communities, and governmental entities:

- Provide support in better storage of fertilizer, animals, tools, etc. to minimize the impacts of flooding in flood-prone areas.
- Whatcom County organizes a small-farmer specific disaster relief, through loans or grants and adds a cap on the amount of profit they generate in a fiscal year to ensure the farm is of the small scale.
- Normalize conversations and community support concerning the increased risk of climate disasters.
- Share information about which crops should be planted preemptively in order to avoid the rising cost of feed, should a natural disaster trigger this economic impact.

- Organize a food hub similar to the one recently established in Snohomish County in order to better support the small-scale farmer and assist in making connections to the community and localizing food chains should supply chains be disrupted by a disaster.
- Foster relationships between farmers and the community members, so that there is more willingness to support when a disaster strikes and the farming process is made more difficult or impossible.

Should time and funding allow, the follow-up research would look deeper into preventative measures that Whatcom County farmers can take in order to defend themselves against the dangers of disasters. Ideally, this would be a hands-on research opportunity, and possibly work with some farms in the county to build or brainstorm methods that could be implemented to successfully continue to farm through the disasters brought on by climate change. One project that could be undertaken in an effort to prepare for disasters in the county would be the funding and construction of a Whatcom County Food and Farm Center. This would mirror the efforts of Snohomish County, and fulfill one of the recommendations made during the conversation. Funding and labor sources would be an element to consider when examining this question more thoroughly.

CONCLUSION

The insights gleaned from this research offer wonderful opportunities for community engagement with small-scale agriculture workers. Fulfilling the suggestions posed in this paper requires community efforts to be made promptly. The foundation of each suggestion is built from increasing the interactions between farms and community members, so encouraging this relationship by offering spaces and avenues for it to develop is crucial. Another large take-away from this research would be that localizing food systems alongside fostering the farmer-community relationship would make the food system more resilient. This would make it easier for the community to uplift itself after the event of a natural disaster.

ACKNOWLEDGEMENTS

I would like to thank Dr. Kate Darby for advising this project, and offering helpful advice and edits throughout the entirety of the research and focus group process. I would also like to thank the farmers of Whatcom County that took the time to share their feelings and insights with me. This work would not have been possible without their trust in me and each other.

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APPENDIX A: Focus Group Guide

Food Access and Farm Resilience Post-Climate Related Disasters

Listening Session Guide

Zoom

Sarah Quenemoen

Note: Follow-up questions are expected as part of a focus group method.

1. Introduce project PI and advisor, if applicable. Read the consent form and ask for verbal consent using the questions at the bottom of the form. After this, begin audio-recording.
2. Short round robin introductions: first name and pronouns (for comfort during focus group), why you started in the agriculture business, current work or projects.
3. **Discussion:** Were you impacted by the flooding in 2021?
4. Were you impacted by the smoke from wildfires in the summer of 2021?
 - a. How did these events impact you, if at all?
 - b. What was the process of cleaning up your property/business following these events?
5. Do you feel that there is infrastructure in place within your network and/or community to support your business and the role it occupies in the county following the events of natural disasters?
6. Do you have any reflections on the relationship between society and the food system that you are contributing to? How would these reflections/perceptions change in the face of disaster?
7. Will the workforce that your business utilizes be able to respond sufficiently to any disasters that take place?
8. Collaborative vs. competitive attitudes amongst the county farms - would this apply to disaster responses?
9. What does adaptation look like to your specific farm or your methods/approaches/business?
10. Are these disasters the thing that worries you the most about farming in this county?

APPENDIX B: WWU IRB Approval (5/6/2022)



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516 High Street, Bellingham, Washington 98225
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www.wwu.edu/compliance

To: Sarah Quenemoen and Kate Darby
From: Stephanie Richey
Subject: Human Subjects Application
Date: 5/6/2022
Action Taken: Exemption Granted
Principal Investigator: Sarah Quenemoen
Faculty Advisor: Kate Darby
Project Title: Food Access and Farm Resilience Post Climate-Related Natural Disasters
Protocol Number: 4671EX22
Funding: The Bullitt Foundation, Bullitt Grant, October 2021 – October 2023; College of the Environment Discretionary Fund for Student Support

The Western Washington University (WWU) Institutional Review Board (IRB) designee determined that your project meets the requirements outlined in §45 CFR 46 and WWU institutional procedures to receive the following exemption determination:

Exempt Category 2

This determination means that your research is valid indefinitely, as long as the nature of the research activity remains the same. You may begin recruitment and data collection. After 6 years, according to the University's retention schedule, this exemption file will be deleted. After this point, you will no longer be able to make modifications to this protocol.

This exemption is given under the following conditions:

1. The research will be conducted only according to the protocol.
2. The research will be conducted in accordance with the ethical principles of Justice, Beneficence, and Respect for Persons, as described in the Belmont Report, as well as with federal regulations and University policy and procedure.
3. PIs, Faculty Advisors, PI Proxies, and any individual interacting or intervening with human subjects or their identifiable data must be appropriately trained in human research subject protections (CITI Basic Social/Behavioral Research – Basic/Refresher course), research methods, and responsible conduct of research **prior to** initiating research activity.
4. The Principal Investigator will retain documentation of all past and present personnel, including documentation of their training(s).
5. The Principal Investigator will ensure that all personnel training(s) remain(s) up to date.

6. IRB approval will be obtained **prior to making any modifications** that affect the research study's eligibility for this exemption category or fundamentally change the research. This includes changes to the Principal Investigator (PI), PI Proxy, or Faculty Advisor (if applicable), subject population, recruitment methods, compensation amounts or methods, consent procedures or documents, or changes in study materials that deviate from the approved scope.

The following types of changes can be made without submitting a modification: Adding or removing research personnel other than the PI, PI Proxy, or Faculty Advisor (if applicable), edits in spelling, punctuation, and grammar on study materials (not including consent forms), minor wording changes to study materials (not including consent forms) that do not change the overall content and resulting comprehension, and adding or editing questions in questionnaires that are within the scope of the questions currently approved.

7. All research records (the application determination packet, correspondence with the IRB, any other IRB-related determinations, signed consent forms, and documentation of research personnel trainings in human research subject protections) will be maintained in accordance with [WWU's guidelines for document retention](#).
8. The IRB will be promptly informed of any issues that arise during the conduct of the research, such as adverse events, unanticipated problems, protocol deviations, or any issue that may increase the risk to research participants.

Thank you for your attention to these details. If you have questions at any point, please review our website (www.wvu.edu/compliance) or contact a Research Compliance Officer.

Research Compliance Officer: Stephanie Richey
Exemption timestamp: 5/6/2022